

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 2, 2019/2020

### **BOM 2064 – QUALITY AND OPERATIONS MANAGEMENT** (All Sections/Groups)

4 MARCH 2020  
9.00a.m – 11.00a.m  
(2 Hours)

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#### INSTRUCTIONS TO STUDENT

1. This question paper consists of 7 pages with 4 questions only.
2. Attempt **ALL** the questions. The distribution of the marks for each question is provided.
3. Please write all your answers in the answer booklet provided.

**QUESTION 1**

- a) Manufacturing and service are often different in terms of *what* is done but quite similar in terms of *how* it is done. Although goods and services often go hand in hand, there are some basic differences between the two. Discuss **FOUR (4)** points of comparison between production of goods and delivery of services. (8 marks)
- b) Wonder Woman Enterprise provides housekeeping and cleaning services to households in Melaka. In September 2019, the company cleaned 100 houses with its standard crew of four cleaners. They worked for 25 days from 9.00am to 5.00pm and utilised 300 liters of cleanser to complete the jobs. In the following month, the company replaced its old cleaning equipment with newly purchased cleaning equipment. It is reported that the four cleaners cleaned 162 houses in 27 days using 405 liters of cleanser. Also, the cleaners managed to complete their daily job faster by 12.5%.
- What is the productivity with the old cleaning equipment? *(Please give your answer in 2 decimal places)* (2 marks)
  - What is the productivity with the new cleaning equipment? *(Please give your answer in 2 decimal places)* (2 marks)
  - What is the change in productivity? Is the decision to purchase and use new cleaning equipment a wise one? *(Please give your answer in 2 decimal places)* (3 marks)
- c) Ms. Suzanne is a young entrepreneur who owns a food truck business in Georgetown, Penang. She is interested to monitor the sales of volcano toast which has been receiving a good demand from the tourists recently. Table below shows the number of volcano toasts sold for the past 10 days.

Day	1	2	3	4	5	6	7	8	9	10
Number of Unit Sold	144	138	159	155	186	215	238	160	178	156

Predict the number of volcano toasts to be sold for the day 11 using the following methods.

- Naïve (1 mark)
- A five-period moving average (2 marks)
- Weighted average with 0.4 (most recent), 0.3, 0.2 and 0.1. (2 marks)
- Exponential smoothing with  $\alpha = 0.3$ . Use 220 for day 6 forecast. (5 marks)

(TOTAL: 25 marks)

**QUESTION 2**

- a) In a service industry, it is highly important for the service system to be well-designed. Explain **FIVE (5)** characteristics of well-designed service systems. (10 marks)
- b) Prolexus Sdn Bhd produces refrigerators and is currently in the final process of applying paint on the refrigerators. Quality control has taken samples for 20 shifts, each consisting of 5 observations (measurements shown below).

Shift \ Observation	Thickness (in mm)				
1	2.7	2.3	2.6	2.4	2.7
2	2.6	2.4	2.6	2.3	2.8
3	2.3	2.3	2.4	2.5	2.4
4	2.8	2.3	2.4	2.6	2.7
5	2.6	2.5	2.6	2.1	2.8
6	2.2	2.3	2.7	2.2	2.6
7	2.2	2.6	2.4	2.0	2.3
8	2.8	2.6	2.6	2.7	2.5
9	2.4	2.8	2.4	2.2	2.3
10	2.6	2.3	2.0	2.5	2.4
11	3.1	3.0	3.5	2.8	3.0
12	2.4	2.8	2.2	2.9	2.5
13	2.1	3.2	2.5	2.6	2.8
14	2.2	2.8	2.1	2.2	2.4
15	2.4	3.0	2.5	2.5	2.0
16	3.1	2.6	2.6	2.8	2.1
17	2.9	2.4	2.9	1.3	1.8
18	1.9	1.6	2.6	3.3	3.3
19	2.3	2.6	2.7	2.8	3.2
20	1.8	2.8	2.3	2.0	2.9

Find the Lower Control Limit (LCL) and Upper Control Limit (UCL) for the range and average. Determine if the process is in control. (Note: Write your answers in nearest TWO decimals). (15 marks)

(TOTAL: 25 marks)

**QUESTION 3**

- a) Prepare a cause and effect diagram to analyze the possible causes of late shipments of merchandize from a supplier. (10 marks)
- b) Discuss **FIVE (5)** reasons why there is a need for supply chain management. (15 marks)

(TOTAL: 25 marks)

**QUESTION 4**

- a) The Ayamas Sausage Factory (ASF) can produce sausages at a rate of 4000 per day. ASF supplies sausages to local restaurant at a steady rate of 200 per day. The cost to prepare the equipment for producing sausages is RM60. Annual holding costs are RM0.80 per sausage. The factory operates 320 days in a year. Find
- i) The optimal run size (4 marks)
  - ii) The number of runs per year (2 marks)
  - iii) The length (in days) of a run (2 marks)
- b) In the JIT philosophy, waste represents unproductive resources; eliminating waste can free up resources and enhance production. Discuss **FIVE (5)** types of waste in the JIT system. (10 marks)
- c) A JIT system uses kanban cards to authorize movement of incoming parts. In one portion of the system, a work center uses an average of 120 parts per hour while running. The manager has assigned an inefficiency factor of 0.25 to the center. Standard containers are designed to hold 5 dozen parts each. The cycle time for parts containers is about 90 minutes.
- i) How many containers are needed? (5 marks)
  - ii) What is the maximum authorized inventory? (2 marks)

(TOTAL: 25 marks)

**RELEVANT EQUATIONS / FORMULAS**

$$1) \text{CL} = \bar{\bar{X}} \quad \text{UCL (R)} = D_4 \bar{R}$$

$$\text{UCL, LCL (X-bar)} = \bar{\bar{X}} \pm A_2 \bar{R} \quad \text{LCL (R)} = D_3 \bar{R}$$

Table for X – bar &amp; R Charts

No of Observation	A2	D3	D4
In sub group $n$			
2	1.88	0	3.27
3	1.02	0	2.57
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2

$$2) \text{UCL c} = \bar{c} + 3\sqrt{\bar{c}}$$

$$\text{LCL c} = \bar{c} - 3\sqrt{\bar{c}}$$

$$3) \bar{p} = \text{Total No of Defective from All Samples} / (\text{No of Samples} \times \text{Sample Size})$$

$$Sp = \sqrt{\bar{p}(1 - \bar{p})/n}$$

$$\text{CL} = \bar{p}$$

$$\text{LCL} = \bar{p} - 3 Sp$$

$$\text{UCL} = \bar{p} + 3 Sp$$

$$4) \text{Capacity Utilization} = \text{Capacity Used} / \text{Best Operating Level}$$

$$5) r = \frac{n \sum XY - [\sum X \sum Y]}{\sqrt{[n \sum X^2 - (\sum X)^2][n \sum Y^2 - (\sum Y)^2]}}$$

$$a = \bar{Y} - b\bar{X}$$

$$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$$

$$6) \text{Exponential smoothing}$$

$$\text{Forecast for the month } t: F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

## 7) Inventory Management:

$$EOQ = Q^* = \sqrt{\frac{2DS}{H}} \quad TC = \frac{Q}{2}H + \frac{D}{Q}S$$

$$EPQ = Q_0 = \sqrt{\frac{2DS}{H}} \sqrt{\frac{p}{p-u}} \quad I_{\max} = \frac{Q}{P}(p-u) \quad TC = \frac{I_{\max}}{2}H + \frac{D}{Q}S$$

$$SS = z(\sigma_d)\sqrt{LT} \quad ROP = \bar{d}LT + z\sigma_d\sqrt{LT}$$

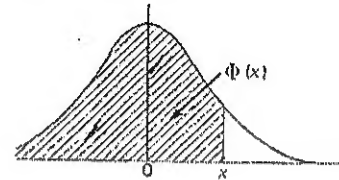
## 8) Lean Operations:

$$N = \frac{DT(1+X)}{C}$$

**Z-TABLE****THE NORMAL DISTRIBUTION FUNCTION**

The function tabulated is  $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-t^2/2} dt$ .  $\Phi(x)$  is

the probability that a random variable, normally distributed with zero mean and unit variance, will be less than or equal to  $x$ . When  $x < 0$  use  $\Phi(x) = 1 - \Phi(-x)$ , as the normal distribution with zero mean and unit variance is symmetric about zero.



$x$	$\Phi(x)$	$x$	$\Phi(x)$	$x$	$\Phi(x)$	$x$	$\Phi(x)$	$x$	$\Phi(x)$	$x$	$\Phi(x)$
0.00	0.5000	0.40	0.6554	0.80	0.7881	1.20	0.8849	1.60	0.9452	2.00	0.9772
0.01	0.5040	0.41	0.6591	0.81	0.7910	1.21	0.8869	1.61	0.9463	2.01	0.9778
0.02	0.5080	0.42	0.6628	0.82	0.7939	1.22	0.8888	1.62	0.9474	2.02	0.9783
0.03	0.5120	0.43	0.6664	0.83	0.7967	1.23	0.8907	1.63	0.9484	2.03	0.9788
0.04	0.5160	0.44	0.6700	0.84	0.7995	1.24	0.8925	1.64	0.9495	2.04	0.9793
0.05	0.5199	0.45	0.6736	0.85	0.8023	1.25	0.8944	1.65	0.9505	2.05	0.9798
0.06	0.5239	0.46	0.6772	0.86	0.8051	1.26	0.8962	1.66	0.9515	2.06	0.9803
0.07	0.5279	0.47	0.6808	0.87	0.8078	1.27	0.8980	1.67	0.9525	2.07	0.9807
0.08	0.5319	0.48	0.6844	0.88	0.8106	1.28	0.8997	1.68	0.9535	2.08	0.9812
0.09	0.5359	0.49	0.6879	0.89	0.8133	1.29	0.9015	1.69	0.9545	2.09	0.9816
0.10	0.5398	0.50	0.6915	0.90	0.8159	1.30	0.9032	1.70	0.9554	2.10	0.9821
0.11	0.5438	0.51	0.6950	0.91	0.8186	1.31	0.9049	1.71	0.9564	2.11	0.9825
0.12	0.5478	0.52	0.6985	0.92	0.8212	1.32	0.9066	1.72	0.9573	2.12	0.9830
0.13	0.5517	0.53	0.7019	0.93	0.8238	1.33	0.9082	1.73	0.9582	2.13	0.9834
0.14	0.5557	0.54	0.7054	0.94	0.8264	1.34	0.9099	1.74	0.9591	2.14	0.9838
0.15	0.5596	0.55	0.7088	0.95	0.8289	1.35	0.9115	1.75	0.9599	2.15	0.9842
0.16	0.5636	0.56	0.7123	0.96	0.8315	1.36	0.9131	1.76	0.9608	2.16	0.9846
0.17	0.5675	0.57	0.7157	0.97	0.8340	1.37	0.9147	1.77	0.9616	2.17	0.9850
0.18	0.5714	0.58	0.7190	0.98	0.8365	1.38	0.9162	1.78	0.9625	2.18	0.9853
0.19	0.5753	0.59	0.7224	0.99	0.8389	1.39	0.9177	1.79	0.9633	2.19	0.9857
0.20	0.5793	0.60	0.7257	1.00	0.8413	1.40	0.9192	1.80	0.9641	2.20	0.9861
0.21	0.5832	0.61	0.7291	1.01	0.8438	1.41	0.9207	1.81	0.9649	2.21	0.9864
0.22	0.5871	0.62	0.7324	1.02	0.8461	1.42	0.9222	1.82	0.9656	2.22	0.9867
0.23	0.5910	0.63	0.7357	1.03	0.8485	1.43	0.9236	1.83	0.9664	2.23	0.9871
0.24	0.5948	0.64	0.7389	1.04	0.8508	1.44	0.9251	1.84	0.9671	2.24	0.9874
0.25	0.5987	0.65	0.7422	1.05	0.8531	1.45	0.9265	1.85	0.9678	2.25	0.9877
0.26	0.6026	0.66	0.7454	1.06	0.8554	1.46	0.9279	1.86	0.9686	2.26	0.9880
0.27	0.6064	0.67	0.7486	1.07	0.8577	1.47	0.9292	1.87	0.9693	2.27	0.9884
0.28	0.6103	0.68	0.7517	1.08	0.8599	1.48	0.9306	1.88	0.9699	2.28	0.9887
0.29	0.6141	0.69	0.7549	1.09	0.8621	1.49	0.9319	1.89	0.9706	2.29	0.9890
0.30	0.6179	0.70	0.7580	1.10	0.8643	1.50	0.9332	1.90	0.9713	2.30	0.9892
0.31	0.6217	0.71	0.7611	1.11	0.8665	1.51	0.9345	1.91	0.9719	2.31	0.9895
0.32	0.6255	0.72	0.7642	1.12	0.8686	1.52	0.9357	1.92	0.9726	2.32	0.9898
0.33	0.6293	0.73	0.7673	1.13	0.8708	1.53	0.9370	1.93	0.9732	2.33	0.9901
0.34	0.6331	0.74	0.7704	1.14	0.8729	1.54	0.9382	1.94	0.9738	2.34	0.9903
0.35	0.6368	0.75	0.7734	1.15	0.8749	1.55	0.9394	1.95	0.9744	2.35	0.9906
0.36	0.6406	0.76	0.7764	1.16	0.8770	1.56	0.9406	1.96	0.9750	2.36	0.9908
0.37	0.6443	0.77	0.7794	1.17	0.8790	1.57	0.9418	1.97	0.9756	2.37	0.9911
0.38	0.6480	0.78	0.7823	1.18	0.8810	1.58	0.9429	1.98	0.9761	2.38	0.9913
0.39	0.6517	0.79	0.7852	1.19	0.8830	1.59	0.9441	1.99	0.9767	2.39	0.9915
0.40	0.6554	0.80	0.7881	1.20	0.8849	1.60	0.9452	2.00	0.9772	2.40	0.9918

## THE NORMAL DISTRIBUTION FUNCTION

$z$	$\Phi(z)$	$z$	$\Phi(z)$	$z$	$\Phi(z)$	$z$	$\Phi(z)$	$z$	$\Phi(z)$	$z$	$\Phi(z)$
2.40	0.99180	2.55	0.99461	2.70	0.99653	2.85	0.99781	3.00	0.99865	3.15	0.99918
41	.99202	56	.99477	71	.99664	86	.99788	01	.99869	16	.99921
42	.99224	57	.99492	72	.99674	87	.99795	02	.99874	17	.99924
43	.99245	58	.99506	73	.99683	88	.99801	03	.99878	18	.99926
44	.99266	59	.99520	74	.99693	89	.99807	04	.99882	19	.99929
2.45	0.99286	2.60	0.99534	2.75	0.99702	2.90	0.99813	3.05	0.99886	3.20	0.99931
46	.99305	61	.99547	76	.99711	91	.99819	06	.99889	21	.99934
47	.99324	62	.99560	77	.99720	92	.99825	07	.99893	22	.99936
48	.99343	63	.99573	78	.99728	93	.99831	08	.99896	23	.99938
49	.99361	64	.99585	79	.99736	94	.99836	09	.99900	24	.99940
2.50	0.99379	2.65	0.99598	2.80	0.99744	2.95	0.99841	3.10	0.99903	3.25	0.99942
51	.99396	66	.99609	81	.99752	96	.99846	11	.99906	26	.99944
52	.99413	67	.99621	82	.99760	97	.99851	12	.99910	27	.99946
53	.99430	68	.99632	83	.99767	98	.99856	13	.99913	28	.99948
54	.99446	69	.99643	84	.99774	99	.99861	14	.99916	29	.99950
2.55	0.99461	2.70	0.99653	2.85	0.99781	3.00	0.99865	3.15	0.99918	3.30	0.99952

The critical table below gives on the left the range of values of  $z$  for which  $\Phi(z)$  takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of  $\Phi(z)$  indicated.

3.075	0.9990	3.263	0.9994	3.731	0.99990	3.916	0.99995
3.105	0.9991	3.320	0.9995	3.759	0.99991	3.976	0.99996
3.138	0.9992	3.389	0.9996	3.791	0.99992	4.055	0.99997
3.174	0.9993	3.480	0.9997	3.826	0.99993	4.173	0.99998
3.215	0.9994	3.615	0.9998	3.867	0.99994	4.417	0.99999
			0.9999		0.99995		1.00000

When  $z > 3.3$  the formula  $1 - \Phi(z) \approx \frac{e^{-1/2z^2}}{z\sqrt{2\pi}} \left[ 1 - \frac{1}{z^2} + \frac{3}{z^4} - \frac{15}{z^6} + \frac{105}{z^8} \right]$  is very accurate, with relative error less than  $945/z^{10}$ .